Quadratics Review
Honors Algebra 2

Name: KEY

Solve the following quadratic equations using the specified method.

Factoring:

1.

$x^2 - 12x + 27 = 0$

$(x-9)(x-3) = 0$

$x = 9$

$x = 3$

2.

$2x^2 + 7x = -3$

$2x^2 + 7x + 3 = 0$

$(2x+1)(x+3) = 0$

$2x+1=0 \qquad x+3=0$

$x = -\frac{1}{2} \qquad x = -3$

Square Root:

3.

$3x^2 - 14 = 40$

$3x^2 = 54$

$x^2 = 18$

$x = \pm\sqrt{18}$

$x = \pm 3\sqrt{2}$

Quadratic Formula:

4.

$-x^2 + 5x + 3 = -2$

$-x^2 + 5x + 5 = 0$

$a = -1$

$b = 5$

$c = 5$

$x = \frac{-5 \pm \sqrt{5^2 - 4(-1)(5)}}{2(-1)}$

$x = \frac{-5 \pm \sqrt{25 + 20}}{-2}$

$x = \frac{-5 \pm \sqrt{45}}{-2}$

$x = \frac{-5 \pm 3\sqrt{5}}{-2}$

or

$x = \frac{5 \pm 3\sqrt{5}}{2}$

Completing the Square:

5.

$x^2 + 4x - 4 = 0$

$x^2 + 4x = 4$

$c = \left(\frac{4}{2}\right)^2 = 4$

$x^2 + 4x + 4 = 4 + 4$

$(x+2)^2 = 8$

$x + 2 = \pm\sqrt{8}$

$x = -2 \pm 2\sqrt{2}$

6.

$-2x^2 - 5x - 12 = 0$

$x^2 + \frac{5}{2}x + 6 = 0$

$x^2 + \frac{5}{2}x = -6$

$c = \left(\frac{\frac{5}{2}}{2}\right)^2 = \left(\frac{5}{4}\right)^2 = \frac{25}{16}$

$x^2 + \frac{5}{2}x + \frac{25}{16} = -6 + \frac{25}{16}$

$\left(x + \frac{5}{4}\right)^2 = \frac{-71}{16}$

$x + \frac{5}{4} = \pm\sqrt{\frac{-71}{16}}$

$x + \frac{5}{4} = \pm\frac{i\sqrt{71}}{4}$

$x = -\frac{5}{4} \pm \frac{i\sqrt{71}}{4}$

Graph in the quadratic equation or inequality:

7.

$y = -4x^2 + 16x - 5$

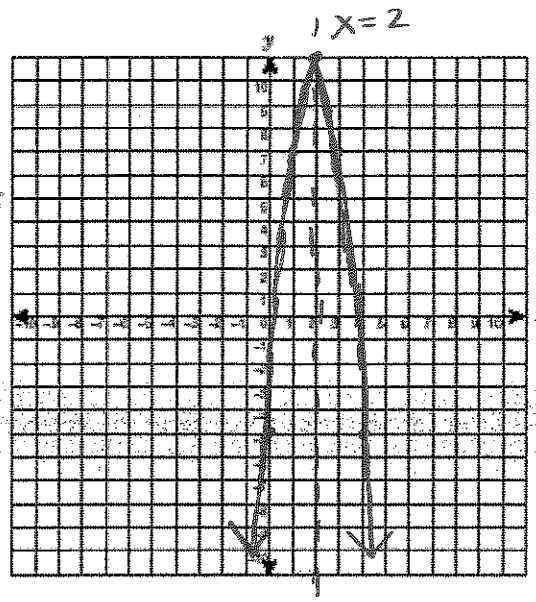
$h = \frac{-16}{2(-4)} = 2$

$K = -4(2)^2 + 16(2) - 5$

$= -16 + 32 - 5$

$= 11$

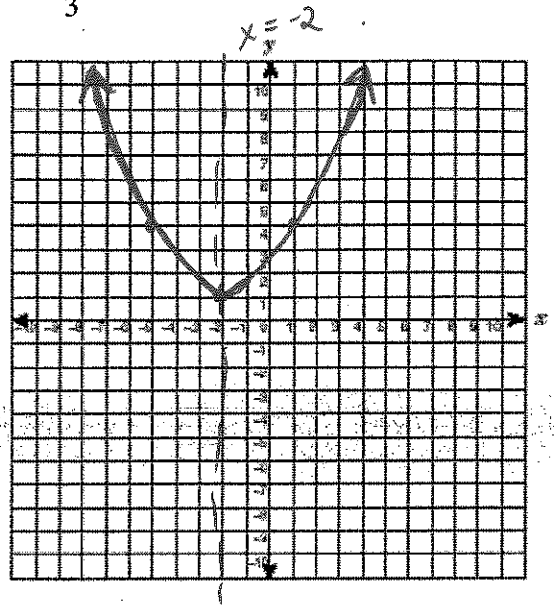
x	y
0	-5
1	7
2	11
3	7
4	-5



x	y
-8	13
-5	4
-2	1
1	4
4	13

8.

$y = \frac{1}{3}(x+2)^2 + 1$



9.

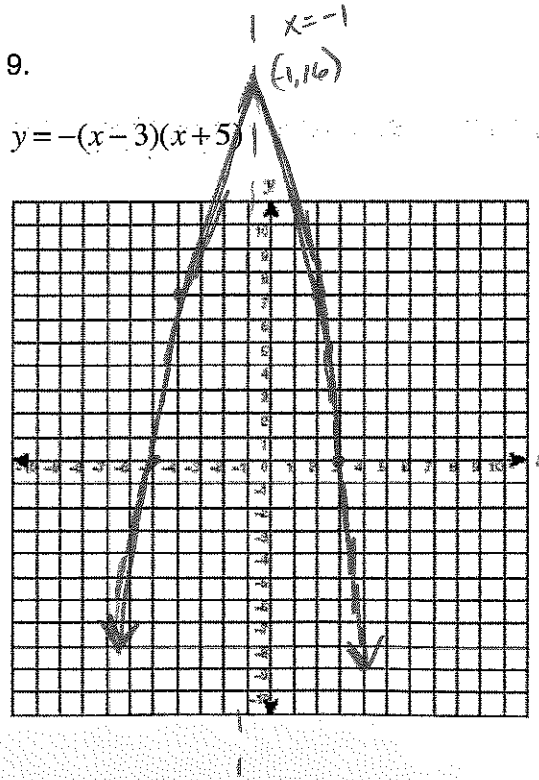
$y = -(x-3)(x+5)$

$h = \frac{3-5}{2} = -1$

$K = -(-1-3)(-1+5)$

$K = 16$

x	y
-5	0
-4	7
-1	16
2	7
3	0



$h = \frac{-8}{2(1)} = -4$

$K = (-4)^2 + 8(-4) + 6$

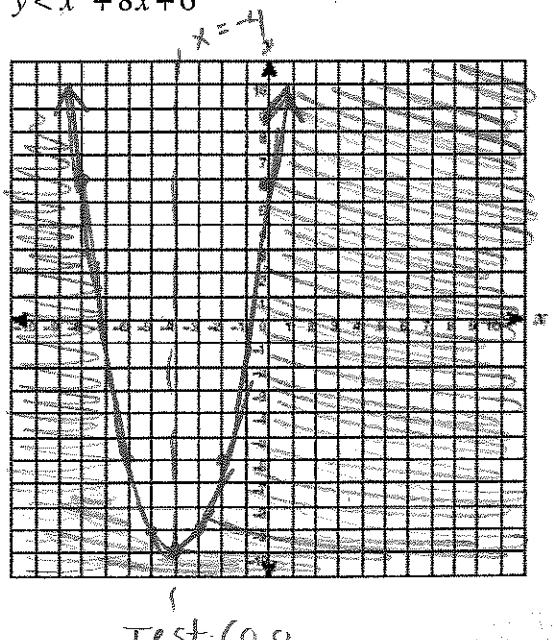
$= 16 - 32 + 6$

$= -10$

x	y
0	6
-2	-6
-3	-9
-4	-10
-5	-9
-6	-6
-7	6

10.

$y < x^2 + 8x + 6$



Simplify:

11. $\sqrt{432}$

$\sqrt{144 \cdot 3}$

$\boxed{12\sqrt{3}}$

12. $\frac{7}{\sqrt{5}}$

$\frac{7}{\sqrt{5}} \cdot \frac{\sqrt{5}}{\sqrt{5}}$

$= \boxed{\frac{7\sqrt{5}}{5}}$

13. $\sqrt{-16}$

$\boxed{4i}$

14. $(3+4i)(1-3i)$

$3 - 9i + 4i - 12i^2$

$3 - 5i + 12$

$\boxed{15 - 5i}$

15. $\frac{6i}{2-i}$

$\frac{6i}{2-i} \cdot \frac{2+i}{2+i}$

$\frac{12i + 6i^2}{4 + 2i - 2i - i^2} = \frac{-6+12i}{1+4}$

$\boxed{\frac{-6}{5} + \frac{12i}{5}}$ or $\boxed{\frac{-6+12i}{5}}$

16. $-5i(2-7i)(-4-i)$

$(-10i + 35i^2)(-4-i)$

$(-10i - 35)(-4-i)$

$40i + 10i^2 + 140 + 35i$

$-10 + 140 + 75i$

$\boxed{130 + 75i}$

Solve (write solution in interval notation):

17. $2x^2 + 4x \geq x^2 - x + 6$

$-x^2 + x - 6 \quad -x^2 + x + 6$

$x^2 + 5x - 6 \geq 0$

$(x+6)(x-1) \geq 0$

C.P. $x = -6 \quad x = 1$

Test: -7 ✓ Test: 0 ✗ Test: 2 ✓

$-6 \qquad 1$

$\boxed{(-\infty, -6] \cup [1, \infty)}$

18. $x^2 + x + 1 > 0$

$x = \frac{-1 \pm \sqrt{1^2 - 4(1)(1)}}{2(1)}$

$x = \frac{-1 \pm \sqrt{1-4}}{2}$

$x = \frac{-1 \pm \sqrt{-3}}{2}$

No real critical points

Test: 0 ✓

$\boxed{(-\infty, \infty)}$

19. $-x^2 + 6x - 9 < 0$

$x^2 - 6x + 9 > 0$

$(x-3)(x-3) > 0$

Critical Point: $x = 3$

Test: 0 ✓ Test: 4 ✓

3

$\boxed{(-\infty, 3) \cup (3, \infty)}$

Word Problems

1.

An object is launched at 19.6 meters per second (m/s) from a 58.8-meter tall platform. The equation for the object's height s at time t seconds after launch is $s(t) = -4.9t^2 + 19.6t + 58.8$, where s is in meters. When does the object strike the ground?

$0 = -4.9t^2 + 19.6t + 58.8$ Divide by -4.9

$0 = t^2 - 4t - 12$

$0 = (t-6)(t+2)$

$t = 6$ and ~~$t = -2$~~

The object strikes the ground 6 seconds after launch.

2.

An object in launched directly upward at 64 feet per second (ft/s) from a platform 80 feet high. What will be the object's maximum height? When will it attain this height?

$$s(t) = -16t^2 + 64t + 80$$

$h = \frac{-64}{2(-16)} = 2$

$K = S(2) = -16(2)^2 + 64(2) + 80$

$= 144$

It takes two seconds to reach the max height of 144 feet.

3.

An object is launched from ground level directly upward at 39.2 m/s. For how long is the object at or above a height of 34.3 meters?

$$s(t) = -4.9t^2 + 39.2t$$

$-4.9t^2 + 39.2t \geq 34.3$

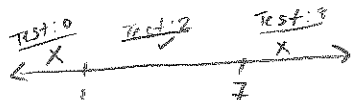
$-4.9t^2 + 39.2t - 34.3 \geq 0$

Divide by -4.9

$t^2 - 8t + 7 \leq 0$

$(t-7)(t-1) \leq 0$

Critical Points: $t=1$, $t=7$.



The object will be at or above 34.3 meters for 6 seconds.

4.

After the semester is over, you discover that the math department has changed textbooks (again) so the bookstore won't buy back your nearly-new book. You and your friend Herman decide to get creative. You go to the roof of a twelve-story building and look over the edge to the reflecting pool 160 feet below. You drop your book over the edge at the same instant that Herman chucks his book straight down at 48 feet per second. By how many seconds does his book beat yours into the water?

mine: $s(t) = -16t^2 + 160$

his: $s(t) = -16t^2 - 48t + 160$

Mine

$0 = -16t^2 + 160$

$16t^2 = 160$

$t^2 = 10$

$t = \pm\sqrt{10}$ $\quad \sqrt{10} \approx 3.16$ seconds

his

$0 = -16t^2 - 48t + 160$

$0 = t^2 + 3t - 10$

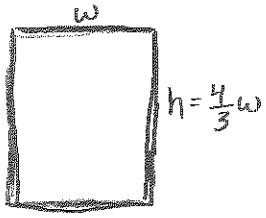
$0 = (t+5)(t-2)$

$t = -5,\ t = 2$

His book beats yours by 1.16 seconds.

5.

A picture has a height that is 4/3 its width. It is to be enlarged to have an area of 192 square inches. What will be the dimensions of the enlargement?



$w \cdot \left(\frac{4}{3}w\right) = 192$

$\frac{4}{3}w^2 = 192$

$w^2 = 144$

$w = \pm 12$

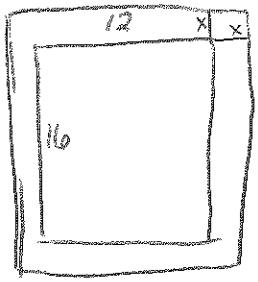
$w = 12$ in

$h = \frac{4}{3}(12) = 16$ in

The dimensions are 12in X 16in

6.

A garden measuring 12 meters by 16 meters is to have a pedestrian pathway installed all around it, increasing the total area to 285 square meters. What will be the width of the pathway?



$(x+12)(x+16) = 285$

$x^2 + 12x + 16x + 192 = 285$

$x^2 + 28x - 93 = 0$

$(x+31)(x-3) = 0$

$x = -31$

$x = 3$

The width of the pathway will be 3 meters.

7.

You run a canoe-rental business on a small river in Ohio. You currently charge $12 per canoe and average 36 rentals a day. An industry journal says that, for every fifty-cent increase in rental price, the average business can expect to lose two rentals a day. Use this information to attempt to maximize your income. What should you charge?

Let x = # of price increases

Price Quantity

$$R(x) = (12 + 0.50x)(36 - 2x)$$

$$R(x) = 0.50(24 + x)\cdot 2(-18 + x)$$

$$R(x) = -1(x+24)(x-18)$$

$p = -24$

$q = 18$

$$h = \frac{-24+18}{2} = -3 \text{ increases (really 3 decreases)}$$

$K = R(-3) = \$441$

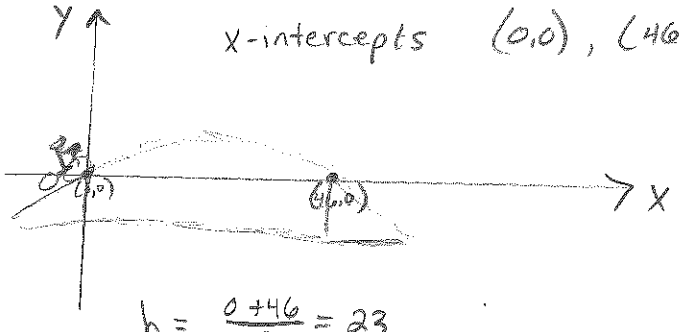
I should lower my price to $10.50 per canoe to maximize my revenue to $441.

8.

Let $y = -\frac{1}{20}x(x-46)$ **represent the path of a motocross rider as he attempts a jump**

where *y* represents the height above the ramp (in feet) and *x* represents the horizontal distance he travels from the take-off ramp to the landing ramp. What is the distance between the two ramps? If the highest point on each ramp is 18 feet, what is the rider's maximum height above the ground?

The distance between the two ramps is 46 feet.



$$h = \frac{0+46}{2} = 23$$

$$K = -\frac{1}{20}(23)(23-46) = \frac{529}{20} = 26.45 \text{ ft}$$

$26.45 + 18 = 44.45$ ft.

He will be 44.45 ft above the ground.